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between open or closed positions.

The controller may include features to store and compare unique codes associated with the remote transmitters, with each remote transmitter having its own unique code initially programmed therein. The unique codes may be added or learned into the controller or deleted from the controller.

Unfortunately, a would-be thief gaining access to the controller may readily enter its programming or learn mode to install the code of an unauthorized remote transmitter. The owner would thus be unaware of such activity, until the thief returns with the unauthorized remote transmitter to open the access door to steal items from within the closed off area.

A remote control system for a garage door sold by Linear Corp. includes an LED that indicates the number of learned remote transmitters by blinking an indicator light which allows the user to confirm the number of such transmitters upon learning a new remote transmitter. Unfortunately, activation of the LED is not readily convenient or accessible to the owner after installation of the controller. This is particularly so since the activation button is carried by a housing that is mounted to the ceiling of the garage. The housing also carries the receiver, the controller and the motor.

Summary of the Invention

In view of the foregoing background, it is therefore an object of the present invention to provide

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coded remote transmitter has been learned.

The indication for whether a new uniquely coded remote transmitter has been learned may include indicating a number of learned remote transmitters.

- 5 This particular feature of the present invention advantageously alerts the user of a potentially unauthorized learned remote transmitter every time the controller is in the door moving mode, i.e., the access door is moved. In one embodiment, the controller
- 10 cooperates with the indicator that the learning mode has recently been exited. This particular feature advantageously alerts the user regardless of whether a new remote transmitter has been learned.

- The remote control system may further comprise
- 15 a remote indicator switch for causing the controller to cooperate with the indicator for indicating whether a new uniquely coded remote transmitter has been learned. This particular feature of the present invention advantageously alerts the user of a potentially
- 20 unauthorized learned remote transmitter without necessarily having to place the controller in the door moving mode, i.e., the access door does not need to be moved.

- The remote control system may further comprise
- 25 at least one light connected to the controller, with the light being energized when the controller is switched to the door moving mode. A remote light switch also preferably causes the light to be energized, and causes the controller to cooperate with
- 30 the indicator for indicating whether a new uniquely coded remote transmitter has been learned. This

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particular feature of the present invention advantageously alerts the user of a potentially unauthorized learned remote transmitter when the light is energized.

5 The indication for whether a new uniquely coded remote transmitter has been learned may also be provided using the remote transmitter comprising a learned transmitter indicator switch for causing the controller to cooperate with the indicator for
10 indicating whether a new uniquely coded remote transmitter has been learned. This particular feature of the present invention advantageously alerts the user of a potentially unauthorized learned remote transmitter using the remote transmitter.

15 In yet another embodiment, the controller comprises a fixed transceiver, and the remote transmitter comprises a remote transceiver and a remote indicator associated therewith. Accordingly, selection of the learned transmitter indicator switch causes the
20 controller to cooperate with the remote indicator via the fixed and remote transceivers for indicating whether a new uniquely coded remote transmitter has been learned.

 In place of or in addition to the controller
25 cooperating with the indicator for indicating a number of learned remote transmitters, the controller may cooperate with the indicator for indicating a change in a number of learned remote transmitters, or for
30 indicating a change in a unique code of the learned remote transmitters. In addition, each learned remote transmitter may transmit a pseudorandomly coded signal

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to the controller.

A first method aspect of the present invention is for moving an access door using a remote control system comprising a controller and at least one uniquely coded remote transmitter. The method may comprise switching the controller to a learning mode for learning a unique code of a remote transmitter to define a learned remote transmitter, and switching the controller to a door moving mode for moving the access door based upon receiving a signal from a learned remote transmitter. An indication of whether a new uniquely coded remote transmitter has been learned is based upon the controller being switched to the door moving mode to thereby alert a user of a potentially unauthorized learned remote transmitter.

In accordance with a second method aspect of the present invention, an indication of whether a new uniquely coded remote transmitter has been learned is based upon activation of a remote switch to thereby alert a user of a potentially unauthorized learned remote transmitter.

Brief Description of the Drawings

FIG. 1 is a schematic block diagram of a remote control system for an access door in accordance with the present invention.

FIG. 2 is a flowchart illustrating one embodiment for remote transmitter verification in accordance with the present invention.

FIG. 3 is a flowchart illustrating another embodiment for remote transmitter verification in

accordance with the present invention.

Detailed Description of the Preferred Embodiments

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

Referring initially to FIG. 1, a remote control system **10** for moving an access door in accordance with the present invention will now be described. In the illustrated embodiment, the access door is a garage door **12** as will now be discussed herein. The present invention is readily applicable to other types of access doors, as readily appreciated by those skilled in the art.

The illustrated remote control system **10** includes a housing **14** mounted to the ceiling of a garage. The housing **14** carries a motor **16** for moving
25 the garage door between open and closed positions. The motor **16** may drive a belt or chain, for example, to which a trolley **18** is attached so that the garage door **12** moves along a rail **20**.

The motor **16** operates in response to a
30 controller **22** that is also carried by the housing **14**.

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In the illustrated embodiment, the controller 22 includes a central processing unit or microprocessor 24 operating under stored program control. A transmitter/receiver 26 is connected to the microprocessor 24 for receiving signals from a remote transmitter 28 and for transmitting signals thereto, as will be described in greater detail below. As would be readily understood by those skilled in the art, the transmitter portion of the controller 22 may not be needed in some embodiments of the invention. An antenna 30 is illustratively connected to the transmitter/receiver 26.

The microprocessor 24 is also operatively connected to a memory 32, such as an EEPROM, for example. As would be readily understood by those skilled in the art, the microprocessor 24 may alternately or additionally have its own on-board memory. An output of the microprocessor 24 energizes a relay 34 for providing power to the motor 16.

Power is initially provided to the microprocessor 24 as well as to the relay 34 by a power supply 36 carried by the housing 14. The power supply 36 typically converts AC power from an external line source to a DC level. The relay 34 also provides power to a light 38. The light 38 is typically energized when the motor 16 is energized, or when a remote wall mounted light switch 40 is pressed. The light 38 may be protected by a transparent or translucent cover 42, for example, that is also carried by the housing 14.

The remote control system 10 includes at least one indicator for alerting the user whether a new uniquely coded remote transmitter has been learned,

which may possibly be an unauthorized remote transmitter. In the illustrated embodiment, the indicator may be an on-board indicator **50** carried by the housing **14** and/or a remote indicator **52** external
 5 the housing. The external indicator **52** is typically mounted on a wall in the garage.

The indicators **50, 52** may be at least one of a light, a visual display, a speech message generator or an audible signal generator as readily appreciated by
 10 those skilled in the art. Other similar indicating devices are also contemplated by the present invention, as would be readily understood by those skilled in the art. In particular, the on-board indicator **50** may be provided by the typical light bulb **38** used for
 15 illumination. The remote indicator **52** may be carried by the same housing that carries the remote switches **46, 40, and 48**, for example.

Activation of the indicators **50, 52** will now be discussed. The controller **22** is switchable between
 20 a learning mode and a door moving mode. The learning mode is for learning a unique code of a remote transmitter **28** to define a learned remote transmitter. Once the remote transmitter **28** has been learned, the controller **22** is switchable to a door moving mode for
 25 moving the garage door **12** based upon receiving a signal from the learned remote transmitter.

The controller **22** cooperates with the indicators **50, 52** for indicating whether a new uniquely coded remote transmitter has been learned based upon
 30 the controller being switched to the door moving mode. The door moving mode is thus achieved when the

controller 22 provides an output signal for causing the motor 16 to be energized via the illustrated relay 34.

This particular feature of the present invention advantageously alerts the user of a potentially unauthorized learned remote transmitter every time the garage door 12 is moved. In fact, the user is still alerted even if the garage door 12 does not move, but the controller 22 is in the door moving mode. For example, the trolley 18 may be disconnected from the drive mechanism, yet the controller 22 is in the door moving mode.

The remote control system 10 further illustratively includes a remote door switch 46 for placing the controller 22 in the door moving mode. Consequently, the user would also be alerted of a potentially unauthorized learned remote transmitter via the indicators 50, 52. In other embodiments, the controller 22 may continuously or repeatedly cooperate with the indicators for indicating whether a new uniquely coded remote transmitter has been learned.

Yet another advantageous feature of the present invention is a remote indicator switch 48 for causing the controller 22 to cooperate with the indicators 50, 52 for indicating whether a new uniquely coded remote transmitter has been learned. In other words, the user is able to determine if there is an unauthorized remote transmitter without moving the garage door 12. In the illustrated embodiment, the remote indicator switch 48 is adjacent the remote light switch 40 the remote door switch 46.

As noted above, the remote control system 10

includes a remote light switch **40** connected to the controller **22** for energizing the light **38**. The remote light switch **40** may also be used for causing the controller **22** to cooperate with the indicators **50**, **52** for indicating whether a new uniquely coded remote transmitter has been learned. As with the remote indicator switch **48**, the user is able to determine with the remote light switch **40** if there is an unauthorized remote transmitter without placing the controller **22** in the door moving mode, i.e., the garage door **12** does not need to be moved. In addition, the light **38** may also be energized to indicate that the learning mode has recently been exited. The light **38** may progressively indicate a passage of time since the learning mode has been exited.

The remote transmitter **28** in accordance with the invention will now be described. The remote transmitter **28** includes a first momentary switch **60** for placing the controller **22** in the door moving mode. An indicating light **62**, such as an LED, indicates when the transmitter within the remote transmitter **28** is transmitting.

The remote transmitter **28** may further include a second momentary switch **64**, referred to herein as a learned remote transmitter indicator switch. Selection of the second momentary switch **64** causes the controller **22** to cooperate with the indicators **50**, **52** for indicating whether a new uniquely coded remote transmitter has been learned.

In addition, the remote transmitter **28** may include a receiver and an indicator **66** associated

therewith so that selection of the second momentary switch 64 causes the controller 22 to cooperate with this indicator via the transmitter/receiver 26 in the housing 14 and the transmitter and receiver within the
5 remote transmitter 28 for indicating whether a new uniquely coded remote transmitter has been learned.

Of course, if the remote transmitter 28 does not include the receiver, then the second momentary switch 64 and the indicator 66 are not required.
10 Consequently, the transmitter portion of the controller 22 would not be required.

As discussed above, the controller 22 is switchable between the learning mode and the door moving mode. The learning mode is for learning a
15 unique code of a remote transmitter 28 to define a learned remote transmitter. When the controller 22 enters the learning mode, all prior learned remote transmitters are deleted. Alternatively, when the controller 22 enters the learning mode, the oldest
20 learned remote transmitter is deleted with the new remote transmitter being learned. In other words, the learning mode for the learned remote transmitters may be in a first in, last out type of arrangement.

In one embodiment, the controller 22
25 cooperates with the indicator 50, 52 for indicating that the learning mode has recently been exited to thereby alert a user of a potentially unauthorized learned remote transmitter. The indication may also be provided via the light 38. The indicators 50, 52 or
30 even the light 38 may progressively indicate a passage of time since the learning mode has been exited.

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In lieu of or in addition to the controller **22** cooperating with the indicators **50, 52** for indicating a number of learned remote transmitters, the controller may cooperate with the indicators for indicating a
5 change in a number of learned remote transmitters, and/or for indicating a change in a unique code of the learned remote transmitters. The controller **22** may also indicate via the indicators **50, 52** that the learning mode has been entered. This indication can be
10 provided by progressively indicating the elapsed time since the learning mode has last been entered.

The system **10** may use pseudorandom or rolling codes wherein the controller **22** is switched to the door moving mode responsive to receiving a correct
15 pseudorandomly coded signal from the remote transmitter **28**. The transmitted signal from the remote transmitter **28** may include a unique identifier portion identifying a transmitter, which is fixed, and a code changing portion synchronized with the receiver **26**, as readily
20 understood by those skilled in the art.

A method aspect in accordance with the present invention for moving an access door, such as the garage door **12**, will now be discussed with additional
reference to the flowchart of FIG. 2. As discussed
25 above, the remote control system **10** includes a controller **22** and at least one uniquely coded remote transmitter **28**. From the start (Block **100**) the method comprises switching the controller **22** to a learning mode for learning a unique code of a remote transmitter
30 **28** to define a learned remote transmitter at Block **102**, and switching the controller to a door moving mode for

The method further illustratively includes indicating whether a new uniquely coded remote transmitter **28** has been learned based upon the controller **22** being switched to the door moving mode. Accordingly, the user is alerted of a potentially unauthorized learned remote transmitter at Block **106**, before stopping at Block **108**.

The method further includes indicating whether a new uniquely coded remote transmitter **28** has been learned based upon activation of at least one remote switch **48** to thereby alert a user of a potentially unauthorized learned remote transmitter at Block **126**, before stopping at Block **128**.

Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented 30 in the foregoing descriptions and the associated drawings. For example, time lapse and code reset

features as disclosed in U.S. Patent No. 6,144,315, for example, which is incorporated herein by reference in its entirety, may be incorporated into the present invention as would be appreciated by one skilled in the art. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims.